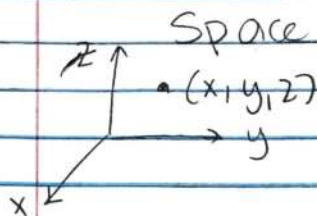## 12.1 coordinate Systems in 3D Space
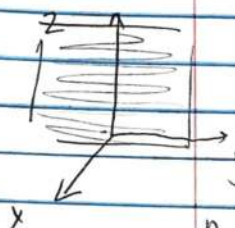

$$3\text{-Space} = \mathbb{R}^3$$

Notation: $\{(x,y,z) \in \mathbb{R}^3\}$

I - coordinate Planes
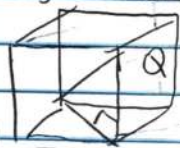
- a coordinate plane in $\mathbb{R}^3$ is a set of planes all which have a coordinate of zero

ie: $(x,y,0)$, $(x,0,z)$, $(0,y,z)$

A- Distances in 3-Space

Distance formula: $\sqrt{(x-x_0)^2 + (y-y_0)^2 + (z-z_0)^2}$

$Q = (x,y,z)$

$P = (x_0, y_0, z_0)$

II - Spheres

Let $P = (x_0, y_0, z_0)$ in $\mathbb{R}^3$ and $r > 0$.

The sphere centered at P and radius r is $S = \{(x,y,z) \in \mathbb{R}^3 : d(P,Q) = r\}$

↳ $r^2 = (x_0-x)^2 + (y_0-y)^2 + (z_0-z)^2$

12.2 Vectors

Vector in $\mathbb{R}^3$ is a directed line segment

head $(4,1)$

$(0,0)$ • tail

} example shown in $\mathbb{R}^2$

↳ vectors are equiv. when they are linear shifts of each other

ex: $(0,0) \rightarrow (1,0) == (2,0) \rightarrow (3,0)$